Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E1

Evaluate the potential for adding additional generation using existing infrastructure, modifying facilities to increase storage and associated generation, and changing operation to provide spinning reserve (e.g., motoring) (Issues addressed: EE 1, 2, and 14).

Resource Goals

- ~~Provide estimates of electrical power generation under varying facility and operational scenario's.~~
- Maximize the benefits from electrical power generation and ancillary services within other operational constraints.
- Add additional power generation capacity if economically feasible.

Scope

~~Studies would include the Oroville-Thermalito complex facilities from Oroville Dam, through the Hyatt powerhouse, and the Thermalito Forebay, Afterbay and powerhouse. Changes to existing facilities could include changes in storage or flow capacities as well as changes in generation capacities at the powerhouses. Changes to operations could include modification to the on-peak to off-peak generation priority, increased pump-back operations, and providing spinning reserves.~~ Within the FERC Project boundary.

Existing Information:

1. Existing facility data – This includes the current water and electrical facility at the Oroville-Thermalito complex. Includes as-built drawings, operation manuals, maintenance records, etc.

2. Existing Operation data – This includes records of historical water and power operations at the Oroville-Thermalito complex. This would include reservoir storages, flows at each Powerplant, and actual power produced.

3. State of California studies currently being undertaken within Oroville FERC project boundary related to adding additional generating capacity.

4. 1997 Hyatt Powerplant Modernization study.

5. 1985 Thermalito Diversion Dam Powerplant study.

6. 1987 Hyatt Powerplant Flood Operations study.

7. Studies performed in the early 1980's to add additional generation capacity at various SWP facilities.

Information Needed:

1. The existing data and modeling needs to be compiled and analyzed to identify potential ways to increase electrical generation benefits.

2. Detailed estimates of electrical power and ancillary service production under the different combinations of infrastructure, physical enhancements, and operations policy that could improve electrical generation benefits.

3. Electrical power market information on demands and prices to allow economic evaluation of electrical generation alternatives.

Level of Analysis

Electric power generation benefits are affected by various factors including the time of day that the power is generated, environmental constraints, hydrology, etc. The electric power analysis will need to be conducted on an hourly basis in order to allow consideration of the time of day variance in the values of electric power generation. This will require detailed computer model simulations of the various alternatives under consideration.

Reconnaissance level study of alternatives for generation capacity increases.

Issues Addressed:

EE1. Consider adding additional generating capabilities (some existing infrastructure).

EE2. Intake on North side of dam - Afterbay outlet motoring to provide spinning reserve.

EE14. Potential physical changes to facility to increase storage and generation. Impacts to existing and potential facilities.

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E2

Evaluate the potential to improve operations through use of real-time watershed hydrologic projections rather than annual projections for flood and non-flood conditions. Coordinate with U.S. Army Corps of Engineers data gathering.

Resource Goals

- Improve accuracy of inflow reservoir level projections
- Improve efficiency of reservoir operations to increase water retained in reservoir storage
- Enhance flood protection
- Improve coordination with U.S. Army Corps of Engineers data gathering in the areaentities.
- Update operational procedures
- Update Feather River computer model if necessary.

Scope

Studies would cover the prediction of snow/rainfall runoff over the Upper Feather River Basin and Oroville Reservoir operations. Studies would examine potential improvements to the quality and quantity of real time hydrologic predictions and their application to short term operation and planning. Short term operation planning covers the time period from the present to the end of the water year, September 30. Feather River watershed above Oroville Dam.

Existing Information

1. Short-term weather forecasts – These are provided daily by DWR and NWS meteorologists and span a period of 10 days. The weather forecasts are typically considered accurate for the first 3 days of the forecasts with more uncertainty for the remaining period.

2. Real time weather and runoff data - The real time data is gathered from a wide variety of sources including other public agencies, reservoir operators, and volunteers in several communities. Public agencies such as the U.S. Army Corps of Engineers provide and share measured real time data.

3. California Data Exchange Center (CDEC) – CDEC is an on-line database operated by DWR. Information on CDEC includes precipitation and temperature data, stream flow data, reservoir operations, snow pack measurements, runoff forecasts, and water supply forecasts. Cooperation of the many public agencies and private entities that contribute to CDEC results in a central location where real time watershed hydrology data is readily available.

4. DWR's Feather River Computer Model - The Hydrology Branch currently operates a Feather River Runoff computer model that takes into account forecasted precipitation and temperatures, measured snow pack, and estimated soil moisture conditions. All of these factors influence the inflow to Oroville Reservoir. This model is run at least once a week and provides a 10-day outlook of forecasted inflows to Oroville Reservoir in six-hour increments. When conditions warrant, the Feather River Runoff model is run as frequently as needed.

5. Nations Weather Services (NWS) Sacramento River Model - This computer model is run jointly with the NWS-RFC forecasters on a daily basis and provides a 5-day outlook at the runoff in the basins of all of the major California rivers, including the Feather River. The model results are provided in six-hour increments. This model operates on similar physical parameters as the Feather River Runoff model and uses in excess of fifteen automated stations in the Feather River basin that collect temperature and precipitation data.

6. PRMS model - The Hydrology Branch continues to upgrade its abilities to provide accurate short-term forecasts for the Feather River basin through improvements to it's current models and is also developing a new physical based model called PRMS.

7. Sacramento and San Joaquin Comprehensive Study.

Information Needed

1. Availability of additional real-time watershed data
2. Historical hydrologic predictions

Historical operation predictions

Historical actual Oroville Reservoir operations

3. Evaluation of existing network of data sensors
4. Comparison of predicted inflow with actual inflow.
5. Upstream reservoir operations

Level of Analysis

The study would rely heavily on historical hydrologic data and reservoir operations data as well as historical hydrologic and reservoir operation predictions (actual versus projected).

Issues Addressed

EE3. Use real-time hydraulic projections, inflow/outflow rather than yearly projections.

EE12. Utilize current watershed hydrologic data from planning (coordinate with COE data gathering).

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E3

Evaluate potential for improved coordinated operation of Oroville Facilities through additional coordination with other water storage facilities and regulatory and resource agencies (e.g. CALFED).

Resource Goals:

Evaluate the potential for the California Department of Water Resources to coordinate the operation of the Oroville Facilities with the following organizations

- United States Bureau of Reclamation
- United States Army Corps of Engineers
- Pacific Gas and Electric Company
- Yuba County Water Agency
- United States National Marine Fisheries Service
- United States Fish and Wildlife Service
- California Department of Fish and Game

Scope of Work:

Existing Information:

Current Coordination Activities

Flood Control

DWR's Flood Operations Center coordinates the releases from the major reservoirs throughout the state of California to minimize flooding. This coordination involves the operations of the Oroville complex by the DWR, Bullards Bar by YCWA, and the Shasta and Folsom complexes by the USBR. This coordination often involves consultation with the USACE.

Hatchery Operations

DWR coordinates with DFG to meet the varying needs of the Feather River Fish Hatchery.

Information Needed:

Level of Analysis

Issues Addressed

EE5. Coordination with releases from other water storage facilities? - for fisheries protection CVP facilities preventing straying of salmon and steelhead.

EE6. Coordination and evaluation of DF & G, USFWS and other regulatory agencies release requirements to better fit with reality. High agency level decision.

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E5

Impact of flood releases on Lake Oroville dam (including need for access to north side of dam) and downstream facilities including downstream levee stability and potential for ameliorating downstream flooding through coordinated releases with other water storage facilities. Consider past floods, improvements in channel carrying capacities, need for more storage (e.g., installing Obermeyer gates on the emergency spillway ogee), operational changes, early warning system for downstream releases, and updating of flood operation manual.

Resource Goals:

- Update flood operation manual
- Minimize flood related impacts at Oroville Dam
- Minimize flood related impacts along the Feather River downstream of Oroville Dam
- Identify potential improvements to flood control operations
- Identify potential improvements to flood control facilities both at Oroville Dam and downstream along the Feather River
- Assure Enhance downstream levee stability
- Enhance Assure adequate downstream channel flow capacity
- Enhance Assure access to north side of dam during flood control operation
- Improve water supply storage
- Improve early warning system and coordination and communication with local and State agencies
- Produce flood inundation maps for various flows
- Establish “boundary of no significant impact”

Scope of Work:

The Feather River basin from Oroville Dam to the point of no significant impact within the context of the Comprehensive Study.

The Feather River basin from Oroville Dam to confluence with the Yuba River, (If this is the area then what are the other facilities to be considered for coordinated releases?) Options to be investigated include

- coordinated releases with other water storage facilities (Which other facilities, there are a number of upstream reservoirs with Lake Almanor being the largest (for Oroville Dam to Yuba confluence), reservoirs in the Yuba basin (for Yuba confluence to Sacramento confluence), and reservoirs on the Sacramento basin (for Sacramento River through Sacramento area)
- improvements in channel carrying capacities of Feather River

- additional flood control storage (e.g., installing Obermeyer gates on the emergency spillway ogee)
- operational changes
- early warning system for downstream releases

Existing Information:

The Flood Operations Manual is available for review at *resource library*.

Currently the Yuba County Water Agency is proposing a comprehensive study to improve flood control on the Feather/Yuba system. This work will continue over the next several years.

Historical data during flood conditions

Information Needed:

1. Anticipated flood control releases
2. Downstream Feather River flows
3. Downstream Feather River Stage
4. Downstream Feather River rates of change in flow and stage
5. Downstream Feather River channel capacity

Level of Analysis:

This will depend on the final scope. Could vary from relatively simple flood routing through the Oroville – Thermalito Complex to full scale flood routing of the Upper Feather River, the Oroville – Thermalito Complex, the Lower Feather River, the Yuba River, the Sacramento River the American River and the Sacramento River flood bypass system.

Issues Addressed

EE11. Coordinate releases with other water storage facilities for flood release

EE17. Update flood operation manual

EE19. Early warning system for downstream releases

EE21. Outflow impacts to downstream flood risk (levee stability) COE?

EE22. Stability of Oroville levee system through low flow section and effects of high flow

EE23. Evaluate channel capacities and potential need for more storage / flood protection engineering and operations deflection into levees by gravel bars

EE47. In the FERC Part 12 guidelines, the Probable Maximum Flood (PMF) is to be examined after each major flood event. The Feather River has had two major flood events since 1971; once in February 1986 and again in January 1997. The FERC Part 12 regulation guidelines also state that when new Hydro-meteorological Reports (HMR's) are issued, the PMF is to be re-examined. New HMR's (HMR 58 & 59) were issued in 1999, thus precipitating the Oroville 2100 project to be re-examined in light of the new data. I think that this has been done for the 2100 project in the last Part 12 inspection and the Work Group should be given the correct data. If not done, the question is why not?

EE51. Provide the Work Group with the study data done on installing Obermeyer Gates on the emergency spillway ogee to raise the reservoir elevation in a major flood runoff event? What is the probability of this installation?

EE52. Provide the workgroup with the latest PMF, HMR, and PMP (probable maximum precipitation) data?

EE53. When was the last "Inflow Design Flood" (IDF) study done and was it done on current data?

EE56. Prepare flood inundation maps for a 1997(?) worse case with 300,000 cfs coming out of the dam's normal and emergency spillways. In 1997, it is believed that Oroville storage was almost to a point where the 300,000 cfs of inflow was going to pass through the reservoir. DWR was making plans to evacuate the power plant. The 300,000 would have topped the levees and put 10 feet of water into the town of Oroville.

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E4

Evaluate environmental and economic aspects of different flow regimes using support system models as a tool (see Issue E2 above). Factors to be considered include timing, magnitude and duration of flows, pump-back scheduling and maintenance scheduling, and hatchery operations.

Resource Goals:

Develop models that accurately evaluate different flow regimes

Scope of Work:

Varies dependent on parameters investigated

Existing Information:

Hydrologic data
Operational data
Existing models:

- DWRSIM, CALSIM, PROSIM operations models
- USBR and UCD temperature models
- DWR's Feather River Runoff model
- NWS Sacramento River model
- DWR PRMS model

Information Needed:

Reservoir levels
Power generation
River channel flow, stage, and temperature

Level of Analysis:

Issues Addressed:

EE4. PLC upgrades?

EE7. Potential to use support system models to evaluate different flow regimes with historic and real-time information

EE8. Why is there no requirement to maintain minimum emergency storage at Lake Oroville? (evaluate needs related to other resources)

EE13. Operational constraints as they relate to other resources

EE25. Operations and engineering of the project determine the manner and extent water is moved into, through and out of the project area. Current operations, which affect timing, magnitude and duration of flow from current release schedules, pumpback scheduling and maintenance schedules impact both lotic and lentic ecosystems affected by the project. Operations need to be examined and their impacts evaluated and minimized for inclusion into terms and conditions of the settlement.

EE26. Facility operations and impact – on bass fishery and spawning activities at afterbay. (protect and enhance bass fishery)

EE28. How does the pump-back operations during the summer months affect water temperatures required for holding and rearing of steelhead and spring-run Chinook salmon in the low-flow section and in the river downstream of Thermalito Afterbay?

EE32. Adequacy of current instream flow requirements to conserve anadromous salmonids, their habitats and forage. This includes providing a range or schedule of flows necessary to optimize habitat, stable flows during spawning and incubation of ingravel forms, flows necessary to ensure redd placement in viable areas, and flows necessary for channel forming processes, riparian habitat protection and maintenance of forage communities. This also includes impacts of flood control or other project structures or operations that act to displace individuals or their forage or destabilizes, scours, or degrades habitat.

EE33. Impact of hatchery facilities and/or operations on anadromous salmonids. This includes the direct, indirect and cumulative impacts of hatchery product on anadromous salmonids and the direct, indirect and cumulative impacts of hatchery facilities and operations on salmonids and their habitats.

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E6

Effect of ramping rates on downstream facilities, power generation, water supply, water temperatures, and fish.

Resource Goals:

Quantify the relationship between ramping rates from the Oroville Facilities, water temperatures and downstream facilities such as levees, marinas, diversions, and recreation areas.

Quantify the effect of ramping rates on power generation.

Quantify (or at least qualify) the effects of ramping rates on fish of interest including rearing and spawning habitats, migration, and angling availability.

Scope of Work:

Oroville Dam to the confluence of the Yuba River.

Existing Information:

Operating restrictions on ramping rates on river releases as referenced in the Oroville Facilities Relicensing Initial Information Package.

Information Needed:

"Ramping rates" will need to be more clearly defined.

A detailed analysis of the relationship between release rates, river stages, and temperature at various locations in the channel will require computer simulations. Models may also help to evaluate the effects of ramping rates on fish when coupled with adequate information on the habitat and behavior of various life stages of the various species of interest.

Level of Analysis:

Issues Addressed

EE10. Ramping rates effects on downstream facilities.

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E7

Effect of the project including discharge (magnitude, frequency and timing) and ramping rates and the altered stream hydrology on substrate scour, mobilization of sediments, turbidity levels, and riparian vegetation in the low flow reach and downstream of the Afterbay

Resource Goals:

Evaluate effects on sediment transport and riparian vegetation.

Scope of Work:

Feather River low flow reach and downstream of the Thermalito Afterbay river outlet.

Existing Information:

River flow and stage data
River temperature data

Information Needed:

Sediment transport analysis
Riparian vegetation survey analysis

Level of Analysis:

Issues Addressed:

EE29. Project features and operations alter the hydrology of the system, creating the possibility for scour zones within both natural and designed channels. What affects do discharge and ramping rates have on substrate scour and the mobilization of sediments into the water column downstream? How have turbidity levels been affected by project operation?

EE30. Alterations in stream hydrology affect the natural fluvial geomorphologic processes of a riverine system. How has the change in magnitude, frequency and timing of peak flows on the Feather River affected riparian vegetation recruitment in the low-flow reach and immediately downstream of the Afterbay?

EE36. Direct, indirect and cumulative impacts of project facilities and operations on sediment movement and deposition, river geometry, and channel characteristics. This includes impacts on stream competence, capacity, bank stability and extent, duration, and repetition of high flow events.

EE41. Direct, indirect and cumulative impacts of project facilities and operations on sediment movement and deposition, river geometry, and channel characteristics. This includes impacts on stream competence, capacity, bank stability and extent, duration, and repetition of high flow events.

EE42. Bedload transport, current condition of habitat potentially impacted by project and alternatives to conserve or enhance

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E8

Effect of reservoir sedimentation and sediments on project operations

Resource Goals:

Evaluate affect of reservoir sedimentation and sediments on project operations.

Scope of Work:

Oroville Lake area.

Existing Information:

1993 – 1994 Lake Oroville Siltation Study

Information Needed:

Determine sediment deposits and rate of sedimentation

Level of Analysis:

Issues Addressed

EE9. Any plan to address increasing siltation in lake?

EE27. Sediments behind dam (operations)

EE 46. At the first workgroup meeting, a presentation was given on how the water system works from reservoir to Southern California. A chart was shown on Oroville reservoir storage denoting the flood storage limits and elevations at time of year and downstream water requirements for the delta. In the presentation, it was said that the data and chart was from 1971 that DWR in Sacramento was using for those storage elevation levels and acre-feet amounts. I question that information and sincerely hope that is not the case.

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E9

Effect of Oroville Facilities power generation pricing schedule on local economy.

Resource Goals:

Identify impacts of power generation pricing on local economy.

Scope of Work:

Analyze the net power cost of operating the Oroville Facilities.

Existing Information:

Operational data

Information Needed:

Change in Oroville operations due to power generation pricing schedule which could be used to evaluate impacts on local economy

Level of Analysis:

Issues Addressed

EE16. Inequity of power pricing structure

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E10

Effect of future water demands on project operations including power generation, lake levels and downstream flows. Consider sale of existing water allotments to downstream users

Resource Goals:

Scope of Work:

Existing Information:

Water Supply Forecasts

Information Needed:

Level of Analysis:

Issues Addressed

EE 18. What are 50-year projections for water/power demands and plans to meet those needs and impacts of meeting demands? (context of existing full allocations)

EE20. Sale of existing water allotments to downstream users

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E11

Effect of tires in Parrish Cove and Bidwell Cove and stakes used to hold down recycled Christmas trees on public safety

Resource Goals:

Scope of Work:

Existing Information:

Information Needed:

Level of Analysis:

Issues Addressed

EE54. Effect of tires in Parrish Cove and Bidwell Cove (mosquito abatement).

EE55. Effects of stakes used to hold down recycled Christmas trees on public safety

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E12

Evaluate operational and engineering alternatives including selective withdrawal from Lake Oroville, Thermalito Afterbay, the hatchery, and the low flow section to meet various downstream temperature requirements

Resource Goals:

Quantify the relationship between various release schemes and water temperature from reservoir to the confluence with the Yuba River.

Scope of Work:

Oroville Dam to downstream of the Thermalito River outlet.

Existing Information:

Water temperature objectives for the Feather River Fish Hatchery are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1-15, 60°F for June 16 through August 15, and 58°F for August 16-31. A temperature range of plus or minus 4°F is allowed for April through November objectives.

The objectives for the Feather River downriver of the Afterbay Outlet are a narrative. During the fall months, after September 15 the temperatures must be suitable for fall-run chinook. From May through August, they must be suitable for shad, striped bass, and other warmwater fish. Water temperatures are met through a shutter controlled intake gate system at the Oroville Dam that allows DWR to select water for release from various reservoir depths.

The water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Rice farmers desire water temperatures of 65°F from approximately April through mid-May and 59°F during the remainder of the growing season. DWR is now trying to accommodate these needs by releasing water at the higher end of the temperature range required for the hatchery.

Information Needed:

Detailed analysis will require a computer simulation tool, which the Department plans to develop with the help of consultants.

Level of Analysis:

Issues Addressed

EE 15. Evaluate temperature requirements and potential Eng. (?) operational modifications

EE 43. Adequacy of selective withdrawal structure to maximize water temperature for anadromous salmonids

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E13

Evaluate operational and engineering alternatives to prevent interbreeding of fall and spring-run Chinook salmon in the low flow section of the Feather River (e.g., migration barrier and/or flow and temperature changes)

Resource Goals:

Scope of Work:

Existing Information:

Information Needed:

Level of Analysis:

Issues Addressed

EE 24. What engineering or other reasonable and prudent solutions are available that would prevent the interbreeding of fall and spring-run Chinook salmon in the low flow section of the Feather River (migration barrier and /or flow and temperature changes in the low flow section)?

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E14

Evaluate operational alternatives that balance and maintain acceptable water quality standards including those for MTBE under all operational plans and conditions

Resource Goals:

Scope of Work:

Existing Information:

Information Needed:

Level of Analysis:

Issues Addressed

EE 37. One of the most significant environmental changes caused by the Oroville Facilities Project was changing the nature of this relatively low elevation waterway from a lotic to lentic system. The confluence of three tributaries of the Feather River and its free flowing nature has been replaced by Lake Oroville. The transport functions (sediment, nutrients etc.) normally associated with the energy of a lotic system have been replaced by an overall storage function of a lentic system. Thus, there are water quality changes accompanying this shift of ecosystems both within and downstream of the lake. The FWS is concerned about the effects of the current project operations on water quality and changes that may occur with new license conditions. We seek assurance that sufficient numbers of water quality constituents are investigated and that appropriate and rigorous protocols are followed. We seek assurance that investigations will lead to determination of operations alternatives that balance and maintain acceptable water quality standards under all operational plans and conditions set forth in the final agreement.

Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet

Issue Statement E15

Evaluate operation alternatives that maintain or improve current water supply under all operation plans and conditions.

Scope of Work:

Resource Goals:

Existing Information:

Information Needed:

Level of Analysis:

Issues Addressed:

EE13. Operational constraints as they relate to other resources and water supply

EE 14. Potential physical changes to facility to increase storage and generation - Impacts to existing and potential facilities.